SOME RESULTS OF INVESTIGATIONS OF MESO- AND MICROCLIMATIC CONDITIONS IN SMALL MOUNTAIN DRAINAGE AREAS IN THE BESKIDES (POLISH WEST CARPATHIANS)

by

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Summary: The autor compares the meso- and microclimatic conditions of the catchment areas of the Jaszcze and Jamne rivers in the Gorce mountains. She distinguishes different sectors with relatively uniform meso- and microclimate within the investigated area and also maps them. She also evaluates the climatic conditions from the point of view of tilling and sylviculture.

Zusammenfassung: Der Verfasser vergleicht die Meso- und Mikroklimaverhältnisse der Sammelbecken des Jaszcze und des Jamne-Flusses im Gorce-Gebirge. Sie unterscheidet verschiedene Bereiche mit verhältnismässig einheitlichen Meso- und Mikroklimat im untersuchten Gebiet und stellt sie auch kartographisch dar. Er bewertet die Klimaverhältnisse auch vom Gesichtpunkt der Landwirtschaft und Forstwirtschaft.

I. Introduction

The object of the present paper is to show the differentiation of meso- and microclimatic conditions in valleys typical of medium high mountains, differing in relief and the degree of forest cover. It is also an estimation of climatic conditions in individual geographical units, taking into account the importance of these conditions in agricultural and forest management.

1. Description of the area and methods of investigation

The Gorce Mts constitute within the Polish Beskides a macroclimatic region of features distincly different from these of neighbouring areas (the Nowy Targ basin and depression of the foothill relief). They are situated in the folloving climatic zones: temperate warm zone (up to 600 m above sea level), temperate cool zone (600 to 1100 m), and cool zone (the summit area; 1100 to 1300 m above sea level).

Two adjacent drainage areas, those of the Jaszcze and Jamne torrents (tributaries of the Ochotnica river), were selected for investigations. The torrents dissect southern slopes of the Gorce Mts with a denivelation of the 400—600 m order. Both drainage areas are located at 600 to 1200 m above sea level (Fig. 1). The greater part of their area falls into the temperate cool climatic zone (lower montane zone with the association *Fagetum carpaticum*), and only the summit area belongs to the cool zone (upper montane zone — association *Piceetum subnormale*).

The Jamne valley, running N—S, is wider, especially is in its upper

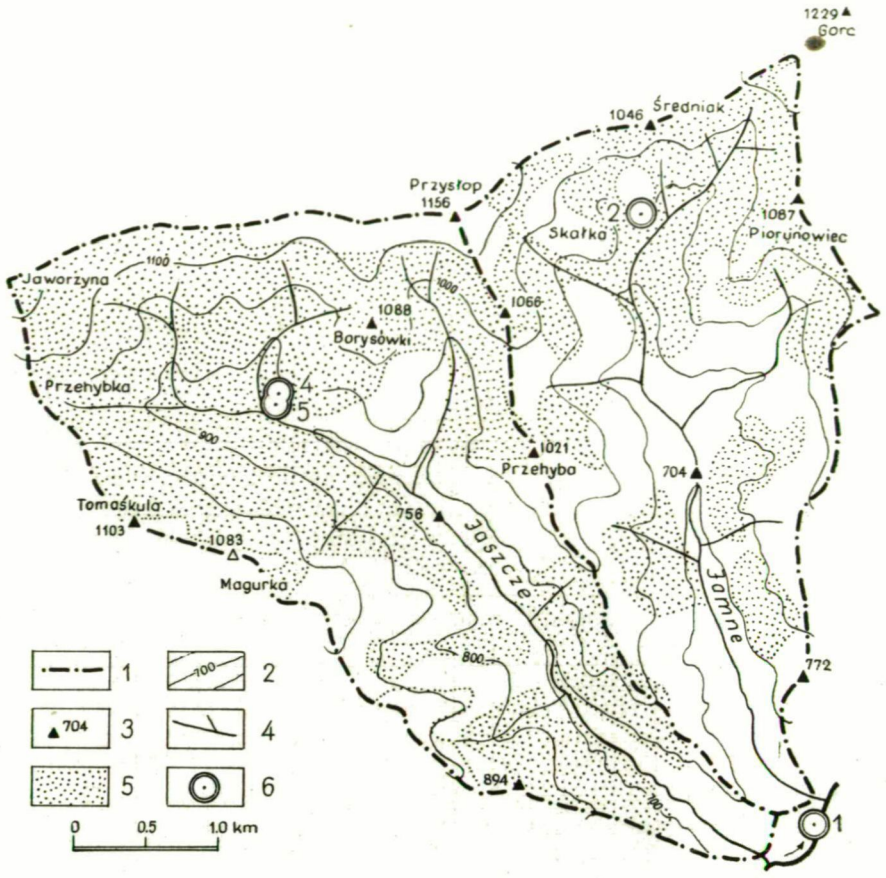


Fig. 1. Relief, watercourses and forests in the drainage areas of the Jaszcze and Jamne torrents.

Explanations of symbols: 1 — watersheds, 2 — contour lines, 3 — points of altitudes, 4 — watercourses, 5 — forests, 6 — meteorological station.

part, and dissected by concentrically converging torrents. The J a s z c z e valley is narrower, steep-walled, longer, and shows fewer subdivisions of the slopes. The J a s z c z e torrent flows (generally) in a NW — SE direction. Both valleys show in their lower parts flat bottoms which reach, e. g. at the mouth of the J a s z c z e torrent, a width of 250 m. The mouth of the J a m n e valley is shaped like a bottleneck. In the drainage areas dominate medium-deep soils, developed on fractions of marl-silicate and quartz-silicate series, frequently of a high humidity degree. The average of forest-covered area in the J a m n e drainage area is 23%, whereas in the J a s z c z e drainage area it reaches 61%. The upper part of the latter is overgrown by quite dense forest (83% of forest cover). In the J a m n e drainage area are the highest situated cultivated fields in the P o l i s h B e s k i d e s, exceeding here 1100 m above sea level. Thus, the location at the upper limit of cultivated fields

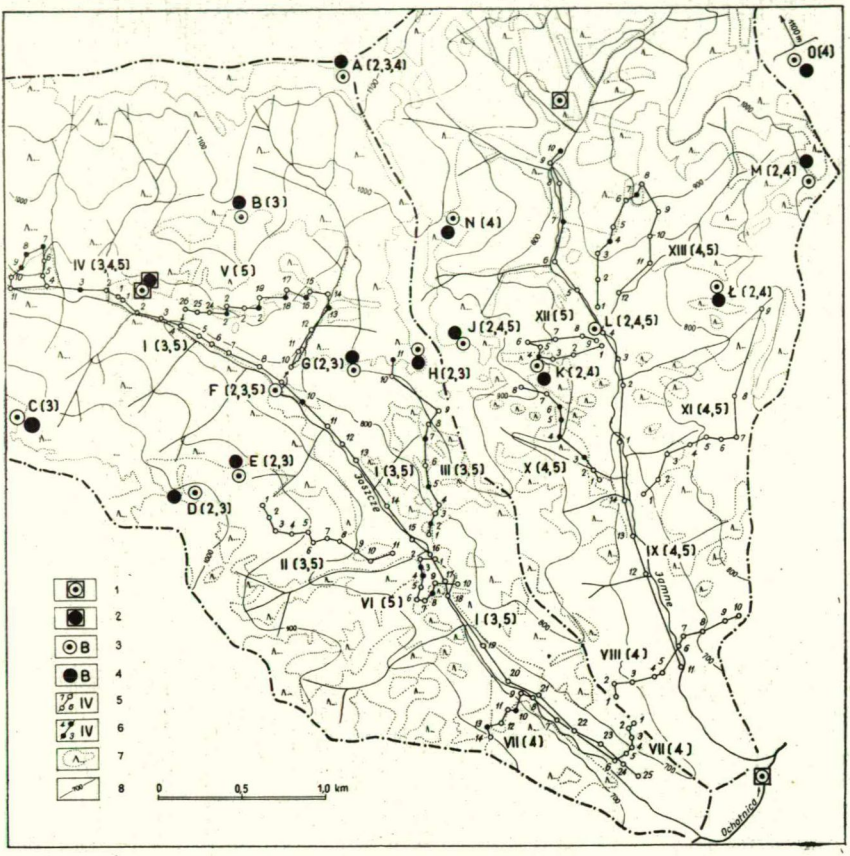


Fig. 2. Distribution of meteorological station, microclimatic investigation points, and routes on which measurements were taken in the Jaszcze and Jamne drainage areas.
Explanations of symbols: 1 — meteorological station in the open, 2 — meteorological station in the forest, 3 — point of microclimatic measurements on a meadow (numbers in parentheseses denominate the year in which the measurements were taken: 2 — 1962, 3 — 1963, 4 — 1964, 5 — 1965), 4 — point of microclimatic measurements in the forest, 5 — points of measurements „en route" on the meadow) Roman numbers denominate numbers of individual profiles of routes, Arabian numbers in parentheses specify the year in which measurements were taken), 6 — points of measurements „en route" in the forest, 7 — forest areas, 8 — contour lines at 100 m intervals.

in the Carpathian Mts. of the valleys discussed permits an estimation of the climatic conditioning of their course.

Wanting to estimate the annual course of temperature and air humidity 4 climatological stations were established in the drainage areas discussed. They worked over a period of 3 years (September 1962 to August 1965) and were equipped with recording instruments (Fig. 2). Elaborating a description of mesoclimatic conditions in the valleys investigated, selected elements and indexes of the climate in a cross-section of the eastern part of Gorce Mts.

were analysed over a period of 3 years, aiming to determine the quantitative interrelations between these and the altitude above sea level. In reference to the work of Hess on mesoclimatic differentiation in the Polish West Carpathians (Hess 1965, 1966 a, b), climatic data from pairs of stations located in similar conditions of relief (Jaszcze and Jamne) and in adjacent areas, but with different vegetation, were compared.

To show the spatial differentiation of meso- and microclimatic conditions in the summer periods between 1962 and 1965, microclimatic measurements were organized at points situated permanently and „en route" in different elements of the relief and at different altitudes in relation to the valley bottoms, as well as in different plant communities. Permanent points of measurements (16 in number) were equipped with Assmann's psychrometers (measurements were done at 5, 50, 100 and 150 cm above the ground), anemometers, ground thermometers, and Piche's evaporimeters. Route profiles were done 3 times in 24 hours (at 4 a. m., 2 p. m. and 8 p. m.).

Supplementary to the above mentioned, conducted were additional observations on the occurence of blowdowns and flag-shaped trees, as well as disappearance of the snow cover and the beginning of cultivating activity in the fields. The disappearance of snow cover received special attention, as it was recognized as a good index of mesoclimatic differences, reflecting the effect of exposition and vegetation.

II. Mesoclimatic conditions in the Jaszcze and Jamne valleys

Analyses of the differentiation of mesoclimatic conditions in mountains of medium height were connected with the definition of mesoclimate as given by Bőer (Bőer, 1959) and supplemented by H. G. Koch (Koch, 1965). And so it was assumed, that mesoclimate is the climate of a definite sector of an area, influenced by its relief, i. e. concave and convex forms of definite morphometric and morphographic features. Of the latter, the width and depth of valleys and their course, as well as exposition and inclination of their slopes deserve attention, for they determine the conditions of sheltering against wind and precipitation, and also the duration and intensity of warming of various surfaces.

On the basis of a 3-year series of observations conducted at stations in the Jaszcze and Jamne drainage areas, as well as at stations of the network of the State Institute of Hydrology and Meteorology, features of the annual course of selected elements of the mesoclimate were analysed.

The analysis of thermal conditions, precipitation, relative air humidity and evaporation showed, that in the areas investigated climatic conditions typical of vertical climatic zones prevail. The mean annual temperature showed a decreasing range of values from 5,8 °C in Kamienica (460 m above sea level) to 3,0 °C on the Turbacz Mtn. (1308 m above sea level). The values of mean monthly temperatures showed similar differences. Annual sums of precipitation showed an increasing range of values from 720 mm in Ochotnica Dolna and Kamienica to 1230 mm on the summits of the Gorce Mts. In accordance with the afore said, the mean annual number of days with precipitation varied between 160 and 180, and with increasing altitude increased also the percental share of days with precipi-

tation (30 to 45% of all days) and the number of days with snow cover) 93 to 154 days).

Besides a general agreement of regularities of differentiation of mesoclimatic condition within certain vertical climatic zones in the West Carpathians, in the strongly dissected group of the Gorce Mts. may appear distinct differences in the mesoclimate of seemingly uniform categories of relief valleys in our case. The ascertainment of these differences called not only for investigation of the annual course of individual climatic elements and index, but also directed our attention to the 24 hr course mainly of air temperature, by computing mean temperatures at day and night in individual months (Table 1). Even if the mean annual temperatures in the Jamne (4,4 °C) and Jaszcze (4,2 °C) valleys were nearly identical, the differences were rather significant in individual months. They reached their maximum in April, in connection with a rise of mean monthly 24 hr temperatures by 0,5 °C in the Jamne valley, and first of all, by a rise of more than 2 °C in the mean monthly minimal temperature.

In the narrow Jaszcze valley strong warming of the air in daytime and marked cooling at night took place. It showed on the average, in relation to the Jamne valley, mean day-temperatures by 0,3 °C, and mean night-temperatures lower by 1,2 °C. The winterless period lasted 5 days longer in the Jamne than in the Jaszcze valley, and at an altitude higher than 800 m above sea level there was even a short thermal summer (period with mean 24 hr temperature exceeding 15 °C). Intense downward flow and stagnation of cool air in the Jaszcze valley resulted in 23 days more with frost, and the frostless period was shorter by 48 days than in the Jamne valley. The distribution of precipitation and relative air humidity did not show any marked differences.

We find confirmation and illustration of mesoclimatic differences in the

Table 1.

Comparison of some climatic indexes in Jaszcze and Jamne drainage areas (period: September 1962—August 1965)

Climatic indexes		Jamne meadow	Jaszcze	
			meadow	forest
Mean yearly temperature		4,4 °C	4,2 °C	4,2 °C
Mean temperature of January		—6,6	—6,1	—6,9
Mean temperature of July		16,0	14,8	15,9
Mean minimal temperature of April		7,7	5,3	6,0
Mean temperature at day-time	of January	—6,6	—6,9	—6,1
	of August	14,2	14,6	13,3
Mean temperature at night-time	of January	—7,8	—8,6	—7,3
	of August	12,6	11,1	11,8
Mean date of first frost		9 X	9 X	19 IX
Mean date of last frost		17 IV	27 IV	15 V
Number days with frost (in year)		53	76	49
Frostless period (in days)		175	127	165
Yearly total of precipitation (in mm)		872	909	—
Values of potential evaporation (in mm)		82	96	113

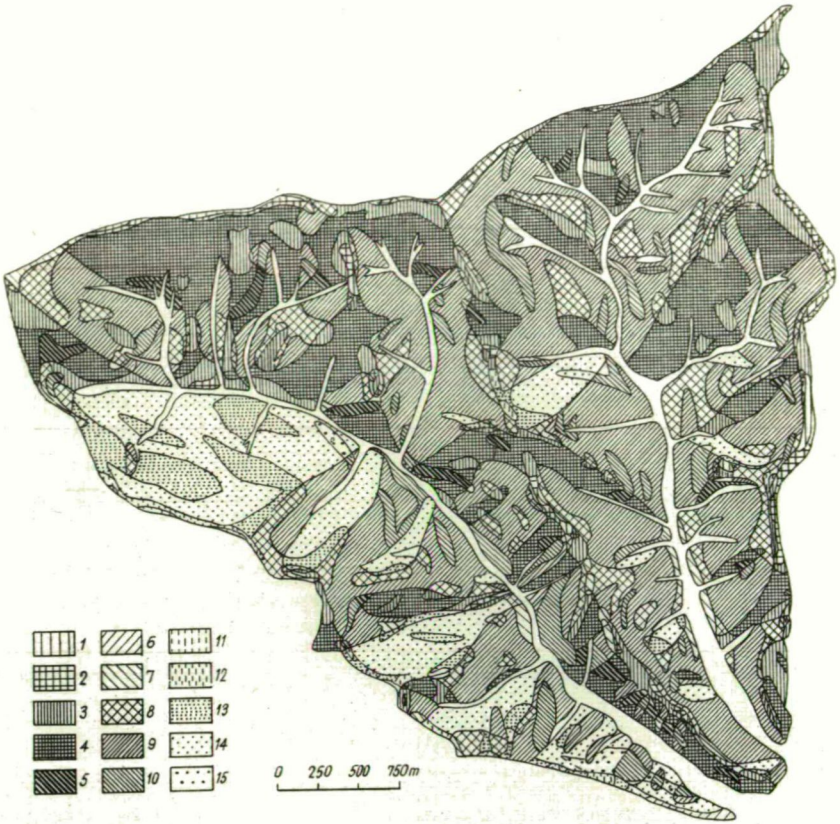


Fig. 3. Map of relative insolation of the drainage areas of the Jaszcze and Jamne torrents, drawn after V. Struzka's method, assuming, that the sum of annual insolation for horizontal surface equals 100%.

Explanation of symbols: Areas exposed southernly: 1 = 101—105%, 2 = 105—112%, 3 = 112—123%, 4 = 123—130%, 5 = above 130%
Areas exposed east — and westwards: 6 = 100—101%, 7 = 101—106%, 8 = 106—110%, 9 = 110—112%, 10 = 112—106%
Areas exposed nothwards: 11 = 100%, 12 = 100—99%, 13 = 99—98%, 14 = 98—71%, s + 15 = 70%

spatial differentiation of the radiation balance for individual forms of relief. One may infer a certain variability of radiation sums in the valleys investigated on the basis of relative insolation. This is shown on a map (Fig. 3), drawn after V. Struzkásmethod (STRUZKA, 1959), assuming that the amount of solar energy falling upon a horizontal surface represents 100%. The relatively small surfaces of valley bottoms were excluded from the thesis and considered flat areas.

The effect of vegetation on mesoclimate was ascertained on the basis of data from stations in the forest and meadow in the Jaszcze valley. In the plot investigated, which is transitional between *Fagetum carpaticum* and *Piceetum abietetosum,* the mean annual temperature of 4,2 °C was identical

with the temperature in the open; a fact deriving from the composition and vertical structure of the tree stand. In the annual course of mean monthly temperatures between May and July, the forest was cooler by 0,5 °C to 0,9 °C, whereas in January and February was warmer by 1,0 °C to 1,3 °C. It increased also mean temperatures at night by 1,0 °C and lowered temperatures in day-time by 0,8 °C. Most significant contrasts between temperatures in the forest and in the open occured in summer, when the extinction of radiation in the tree canopy reached its maximum. Great differences appeared also in winter as a result of counteraction of the vegetation against radiating away of heat. Winter was shorter here by 2 days, early spring and spring, also growing season, longer by 3 days than on the meadow. There were 27 days fewer with frost and 9 days fewer with strong frost in the forest. The frostless period was longer by 38 days. In the warm season, the forest diminished the potential evaporation (sums smaller by more than 20 mm).

III. Microclimatic conditions in the Jaczcze and Jamne valleys

Microclimatic conditions, i. e. the regime of climatic elements in the air layer near ground level in small areas, are conditioned by the stratum, namely the exposition of slopes, differentiation of plant communities and soil. Thus, investigations of the meso- and microclimate call for a thorough analysis of the spatical distribution of climatic elements on the basis of a sound knowledge of the geographical milieu. Certain activities in recent years have been devoted to find sufficiently „sensitive" indicators, reflecting the ampleness of meso- and microclimatic differentiation Special importance was here ascribed to 24-hr course of air temperature, stressing that it reflects the effect of basic factors: radiation and atmospheric circulation. It is also the exponent of a given element of relief in processes of heat exchange and connected local air circulation taking place in the valley. 24-hr changes of air temperature are smaller on convex forms; on concave forms they are greater. One may obtain a quantitative evaluation of these changes by an analysis of amplitudes of 24 hrs and mean temperatures in day-time and at night (GOLCBERG, 1967, MISZCZENKO 1962, 1967), the sums of active temperatures (KISS, 1959), or the frequency of variations between hourly values of air temperature and the mean temperature of 24 hrs (KOCH, 1961, 1965, SCHÖNE 1958).

Operating with data from several short series of microclimatic measurements in periods of calm and fine weather, and on the basis of the 24-hr course of temperature, 3 mesoclimatic regions were distinguished in areas of medium-high mountain relief. They reflect the effect of large concave and convex forms on the 24-hr course of temperature (Fig. 4). These regions are: 1. the region of cool summits, 2. the region of warmer, over-inversive slopes, and 3. the region of inversive valley parts, extending on the average 120 to 140 m above they valley bottom. The region of summits, remaining under the influence of frequent advection of air masses, reflects the differentiation of climatic elements, depending on the altitude above sea level. On the other hand the climatic conditions of both remaining regions are connected with their respective forms of relief. Within these regions appears a further distinction of climatic conditions, and various factors determine the definition of the successive lower units.

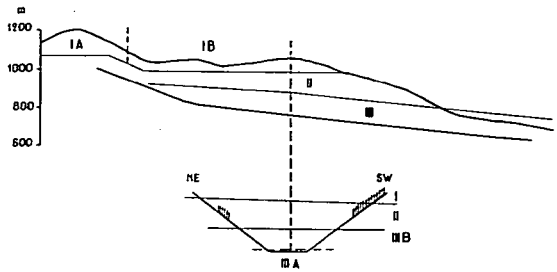


Fig. 4. Distribution pattern of mesoclimatic regions and sub-regions, as well as microclimatic regions in valleys in the southern slopes of the Gorce Mts. (in diagonal and longitudinal cross sections).

Explanations of symbols:
Longitudinal: I — region of cool summits (IA — of the main summit, IB — relatively warmer summits of lower ridges), II — warm, over-inversive slopes and low water-parting ridges, III — region of inversive valley parts.
Diagonal: IIIA — sub-region of valley bottoms, IIIB — lower parts of slopes, subject to inversion, IIa — microclimatic region of warmest, over-inversive slopes, IIb — microclimatic region of temperate warm, over-inversive slopes.

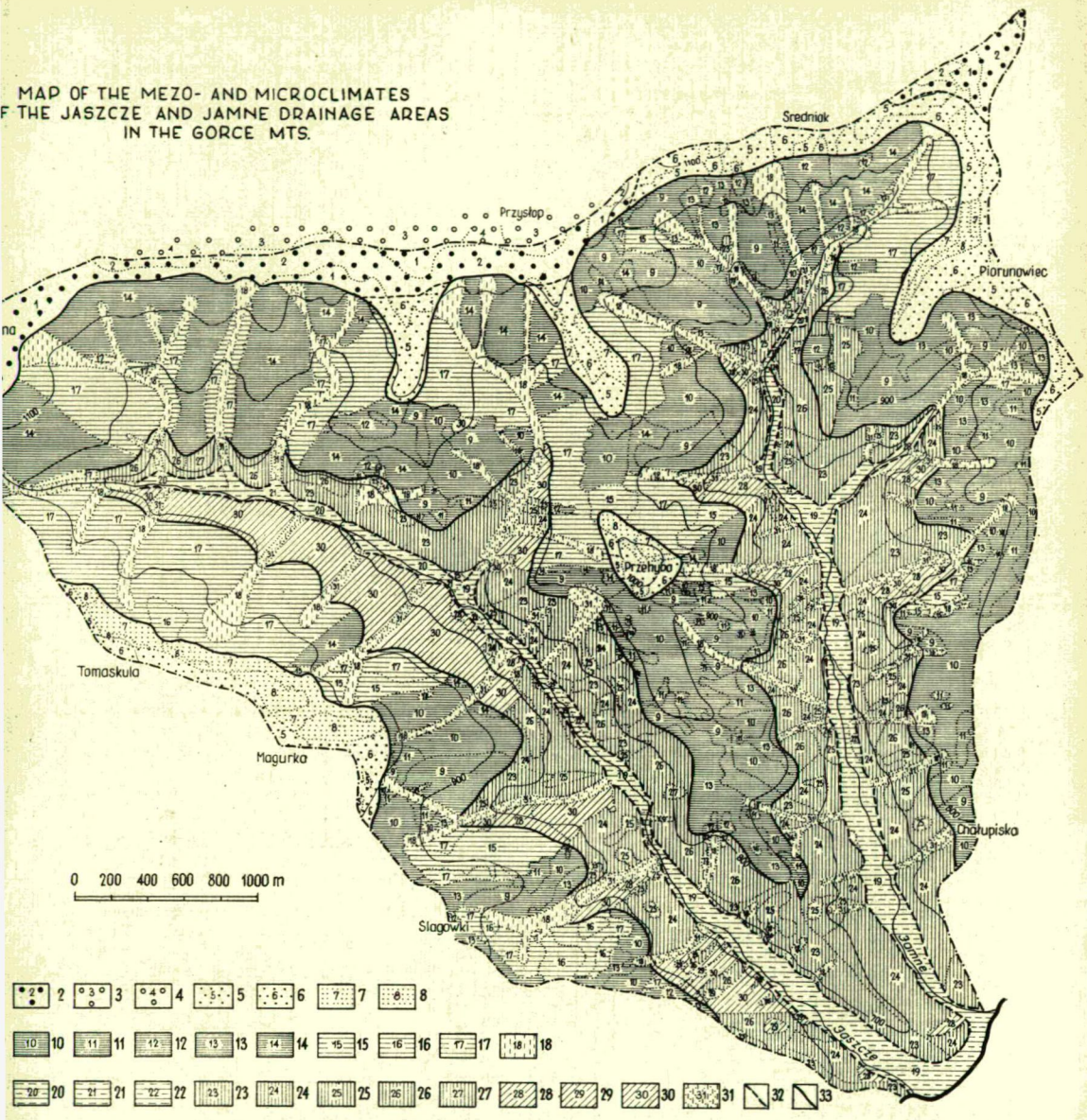
And so, in mesoclimatic regions, in connection with their differentiated relief (valley bottom, ridges), one may distinguish mesoclimatic sub-regions. Within the latter, mainly exposure (the amount of heat obtained) differentiates the thermal regime in the air layer near ground level. At a farther position appears the effect of plant communities, amongst which forest communities moderate, the 24-hr variations of climatic elements. The great mosaic of types and spatial patterns of plant communities becomes obvious in the occurence of as many as 31 microclimatic sub-regions (Fig. 5 & Table 2).

Depending on the altitude above sea level of ridges and valley bottoms, the mesoclimatic regions remain in different relations to the vertical climatic zones in all the Gorce Mts. In the Jaszcze and Jamne valleys, the mesoclimatic regions of warm, over-inversive slopes and inversive valley parts are located within the temperate cool zone. However, the summit region lies entirely in the cool climatic zone.

IV. Climatic contrasts in the Jaszce and Jamne valleys

In both valleys investigated there are nearly similar mesoclimatic regions; nevertheless, there appear differences in the spatial distribution and percental share of structural units of lower order. This is conditioned by features of relief different for each valley and different extents of deforestation. The greatest contrast is visible between the upper parts of the drainage areas (Fig. 5). These differences illustrate excellently the causes of the annual thermal regime in both drainage areas.

The narrow Jaszcze valley is characterized within the mesoclimatic region of inversive valley bottoms by the alternate occurrence of numerous small distentions and contractions, which at night constitute reservoirs of



cool air, in day-time however are intensely warmed. Furthermore, the thermal-humidity conditions in the whole valley appear in sharper contrast between slopes overgrown by forest and those without any in the central and lower part of the valley, than between northern and southern slopes with compact forest complexes in the spring area. Compared with the J a m n e drainage area, the meso- and microclimatic regime of the J a s z c z e drainage area is harsher, the greatest differences appearing in the upper parts of the valleys. The wide valleyhead of the Jamne, exposed southwards, gets more heat, and milder thermal conditions are facilitated by a more even warming of the thinly forest-covered slopes with western and eastern exposure in the central

Table

Classification of meso- and microclimate in the Jaszcze and Jamne drainage areas
(Explanations to the map of meso- and microclimate)

Meso-climatic region	Mesoclimatic sub-region	Microclimatic region	Microclimatic sub-region	Symbol on map
I Cool summits	A Cooler summits of main ridge, exposed to advection or fresh air masses mean 24 hrs' temp. 16,0—16,5 °C ;mean day temp. 17,0—17,5 °C; mean night temp. 14,0 °C; absolute amplitude of temp. 18,0 °C	a Warm southern slopes mean 24 hrs' temp. 16,5 °C; mean day temp. 17,5 °C; mean night temp. 13,8 °C; insolation period 10 hrs	a_1 Forests of the association Piceetum subnormale with smaller 24 hrs' oscillations of air temp.; mean day temp. — mean night temp. = 2,5—3,0 °C; mean 24 hrs' amplitude 4,0—4,5 °C	1
			a_2 Meadows and cultivated fields with larger 24 hrs' oscillations of air temp.; mean day temp. — mean night temp. = = 3,5 °C; mean 24 hrs' amplitude up to 8,0 °C	2
		b Cool northern slopes mean 24 hrs' temp. 16,0 °C; mean day temp. 17,0 °C; mean night temp. 14,0 °C; insolation period shorter by about 1 h	b_1 Forests of the association Piceetum subnormale with smaller 24 hrs' oscillations of air temp.; mean day temp. — mean night temp. = up to 2,5 °C; mean 24 hrs amplitude about 4,0 °C	3
			b_2 Meadows and cultivated fields with relatively larger 24 hrs' oscillations of air temp.: mean day temp. — mean night temp. = 3,0 °C; mean 24 hrs' amplitude about 5,0 °C	4
	B Relatively warmer summits of lower ridges, situated in the lee of main ridge mean 24 hrs 'temp. 17,2—18,5 °C; mean day temp. 18,0—19,5 °C; mean night temp.	a Warm southern slopes mean 24 hers' temp- up to 18,5 °C; mean day temp. 18,5—1,95 °C; mean night temp. 15,0—16,5 °C;	a_1 Forests of the association Piceetum subnormale with smaller 24 hrs' oscillations of air temp.; mean day temp. — mean night temp. = up to 2,0 °C; mean 24 hrs' amplitude about 4,0 °C;	5
			a_2 Meadows and cultivated fields with larger 24 hrs' oscillations of air temp.; mean day temp. — mean night temp. = below 3,0 °C; mean 24 hrs' amplitude 6,0—7,0 °C	6

	15,0—16,5 °C; absolute amplitude of temp. 14,0 °C	b Cool northern slopes mean 24 hrs' temp. 17,0—17,5 °C; mean day temp. 18,0—18,5 °C; mean night temp. 15,5—16,5 °C; insolation period shorter by about 2 hrs' than on slopes exposed southernly	b_1 Forests of the association Piceetum subnormale with smaller 24 hrs' oscillations of air temp.; mean day temp. — mean night temp. = below 2,0 °C;	7
			b_2 Meadows and cultivated fields with relatively larger 24 hrs' oscillations of airt temp.; mean day temp. — mean night temp. = 2,0—3,0 °C; mean 24 hrs' amplitude 6,0 °C;	8
II Warm, over-inversive slopes and low water-parting ridges		a Warmest, over-inversive slopes, strongly dried, with high 24 hrs' maxima and minima of air temp, mean 24 hrs' temp. 18,3—19,6 °C; mean day temp. 19,2—20,0 °C; mean night temp. 16,5 °C;	a_1 Warmest, forestless slopes with southern exposition; mean day temp. — mean night temp. = 3,0—3,5 °C; mean 24 hrs' amplitude 7,0 °C;	9
			a_2 Forestless slopes exposed W, E and lower parts of ridges below 1000 m above sea level, warm; mean day temp. — mean night temp. = 3,0 °C; mean 24 hrs' amplitude 6,5—7,0 °C;	10
			a_3 Forest patches on slopes exposed W, S, E, slightly soothing 24 hrs' amplitudes; mean 24 hrs' amplitude lower by 1,0 °C compared to surroundings	11
			a_4 Forest glades on slopes exposed W, S, E, with marked contrasts of day and night temp.; mean 24 hrs' amplitude up to 10,0 °C	12
			a_5 Forest patches on slopes exposed W, S, E, with milder 24 hrs' amplitudes; mean 24 hrs' amplitude 4,0—4,5 °C;	13
			a_6 Dense forest complexes on slopes exposed southwards and similar cooler ones, but warmer (by 0,5 °C) than at the remaining expositions; mean day temp. — mean night temp. = below 3,0 °C; mean 24 hrs' amplitude 3,0—4,0 °C;	14

Meso-climatic region	Mesoclimatic sub-region	Microclimatic region	Microclimatic sub-region	Symbol on map
		b Temperate warm, over-inversive slopes mean 24 hrs' temp. 17,0 °C; mean day temp. 18,0 °C; mean night temp. 15,5 °C	b_1 Cooler, forestless slopes exposed northwards, with low mean day and 24 hrs' temp.; mean day temp. — mean night temp. = below 3,0 °C; mean 24 hrs' amplitude about 6,0 °C	15
			b_2 Forest glades on slopes exposed NW, N, NE, with smaller 24 hrs' contrasts, less warmed in day-time; mean 24 hrs' amplitude up to 8,0 °C	16
			b_3 Dense forests on northern slopes, as well as in other exposition, cooler, shaded and less warmed; mean day temp. — mean night temp. = 2,5 °C; mean 24 hrs' amplitude 3,0—4,0 °C	17
		c Chutes of flowing down cool air, pockets of cool air in landslide and wet depressions on slopes with mires		18
III Inversive valley depressions	A Valley bottoms with largest oscillations of day and night temperatures; mean 24 hrs' temp. 17,0 °C; mean day temp. 19,0 °C; mean nihgt temp. 13,2 °C; absolute amplitude of temp. 19,0—21,0 °C;		a_1 Pockets of cool air in strongly warmed distentions of valley bottoms with largest 24 hrs' oscillations of air temp.; mean 24 hrs' amplitude 13,5 °C;	19
			a_2 Pockets of cool air in shaded, less warmed distentions of valley bottoms; mean 24 hrs' amplitude 12,0 °C	20
			a_3 Valley narrowings between larger pockets of cool air, shaded and less warmed; mean 24 hrs' amplitude 12,0 °C	21
			a_4 Wet areas (mires), with great air humidity and smaller 24 hrs' oscillations of air temp.; mean 24 hrs' amplitude 11,0—11,5 °C	22
	B Lower parts of slopes subject to inversion mean 24 hrs temp. raises from 17,0 to	a Warm slopes exposed ENE to S and on to WSW, better warmed and dried mean	a_1 Warmest, forestless slopes exposed southernly; mean 24 hrs' amplituden 8,0—11,0 °C	23
			a_2 Warm, forestless slopes with eastern and western exposition; mean hrs' amplitude 7,0—9,0 °C	24

18,0 °C; mean day temp. 19,0—10,5 °C; mean night temp. 13,5—16,0 °C;	24 hrs' temp. about 18,0 °C; mean day temp. about 19,5 °C; mean night temp. 13,5—16,0 °C (increases with raising altitude above the valley bottom) maximal 24 hrs deficit in air humidity more than 20 mb	a_3 Forest patches on slopes exposed W, S, E, less warmed and cooled, slightly moderating 24 hrs amplitudes; mean 24 hrs' amplitude smaller on the average by 1,0 °C than surroundings	25
		a_4 Compact forests of the association Fagetum carpaticum on slopes exposed, W S, E, cooler and showing smaller differences between mean day and night temp. (about 4,0 °C); mean 24 hrs' amplitude below 8,0—10,0 °C	26
		a_5 Forest glades exposed southwards showing large thermal contrasts between day and night-time; mean 24 hrs amplitude up to 12,0 °C	27
	b Cooler and moister slopes exposed northwards mean 24 hrs' temp. 17,0—17,5 °C; mean day temp. about 19,0 °C; mean night temp. — as in „a" maximal 24 hrs deficit in air humidity up to 10 mb	b_1 Forestless slopes exposed northwards, cooler in relation to slopes of other exposition; mean 24 hrs' amplitude 7,0—8,0 °C	28
		b_2 Forest glades on slopes exposed northwards, with smaller 24 hrs' contrasts of day and night temp., slightly warmed in day-time; mean 24 hrs' amplitude 7,0—9,0 °C	29
		b_3 Compact forests of the association Fagetum carpaticum with small 24 hrs' oscillations of air temp., cool; mean 24 hrs' amplitude about 4,0 °C	30
	c Chutes of flowing down cool air and wet depressions on slopes with mires, with lower mean 24 hrs' temperatures and frequently high air humidity; 24 hrs 'temp. minima lower in chutes by 1,0—2,0 °C, in niches by 3,0—4,0 °C compared with surroundings; 24 hrs' maxima of the deficit in air humidity 6,0—8,0 mb		31

32 borders of sub-regions, 33 borders of regions

Attention

[1] Values given in table are preliminary; they refer to a level 100 and 150 cm above the ground and derive from permanent observation posts and investigation points „en route", and were obtained in July 1963.

and lower part of the valley. The wide valley bottom constitutes here a uniform and compact reservoir of cool air, terminating in a bottleneck only just at the mouth of the Ochotnica valley.

V. Estimation of climatic conditions of the Jaszcze and Jamne valleys from the point of view of the needs of agricultural and forest management

The acquirement of knowledge about the climate of individual forms of relief and plant communities promotes the selection of areas with conditions most advantageous to agricultural management, and permits a comparison with the manner of land use practised up to now. Tilling in the area investigated is concentrated in the temperate cool zone. With increasing altitude above sea-level the air temperature decreases, the growing season becomes shorter (175 to 128 days), and precipitation increases. The mesoregion of warm, over-inversive slopes, the microclimatic sub-region of warmest slopes exposed southwards ($IIaa_1$), with earliest disappearence of snow cover, soonest of the soil in spring, and least exposure to frost is most advantageous to cultivation. Similarly favourable, on account of their long growing season, are bottom — mostly valley parts (about 600 m above sea level), in spite of the danger of frost, and also somewhat less warmed, over-inversive sectors of slopes exposed east- and westwards ($IIIaa_2$). As shown on the map (Fig. 5), more area suitable for cultivation concentrates in the Jamne valley, especially in its upper part. The present state of land use is in most instances correct, as cultivated fields reaching a record altitude for the Beskides of 1150 m above sea level, are situated frequently in the central and upper parts of slopes, while lower parts are covered by forest.

The occurence in the Gorce Mts. of a border of cultivated fields situated at such a high altitude is conditioned not only by economic considerations, but it reveals also the keen practical knowledge of the highlanders about the features of climatic conditions. These same considerations determine also the shifting of the border of orchards on the southern slopes of the Jamne valley to altitudes exceeding 900 m above sea level, a record altitude of its kind within all the Polish Carpathian Mts. However, on the slopes with northern exposition, the cultivation/timber line appears about 900 m above sea level. These facts prove, that the differentiation of meso- and microclimatic conditions in the area of medium-high mountains is one of the most important factors reflecting on the whole of man's management in the natural habitat.

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